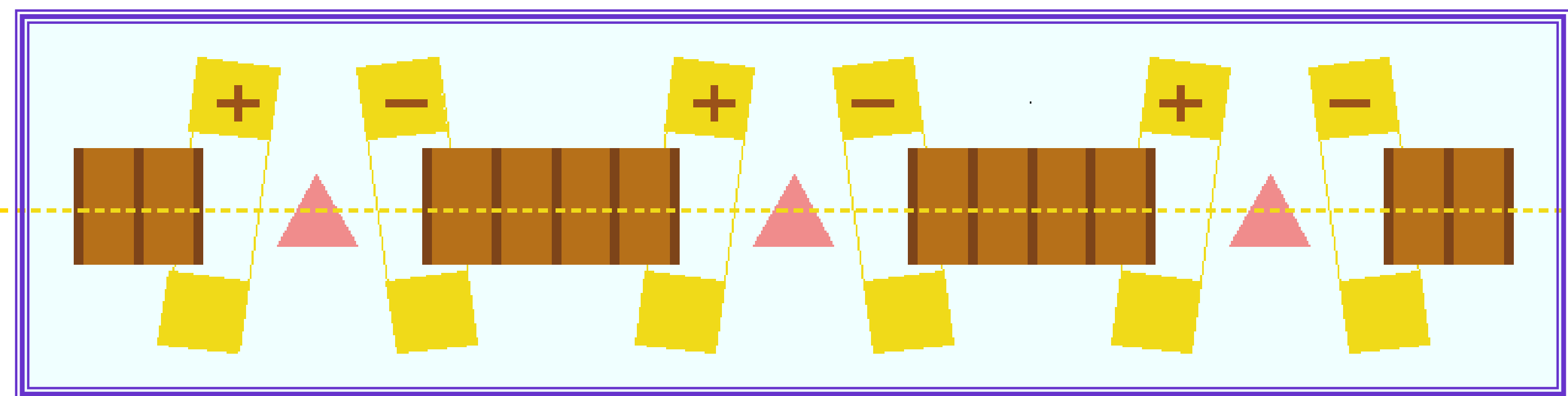


**Abstract** Alternate solenoid 4D cooling channel is considered. It is shown that it can be transformed to a rectilinear 6D cooling channel by small alternating tilt of the solenoids

## Introduction

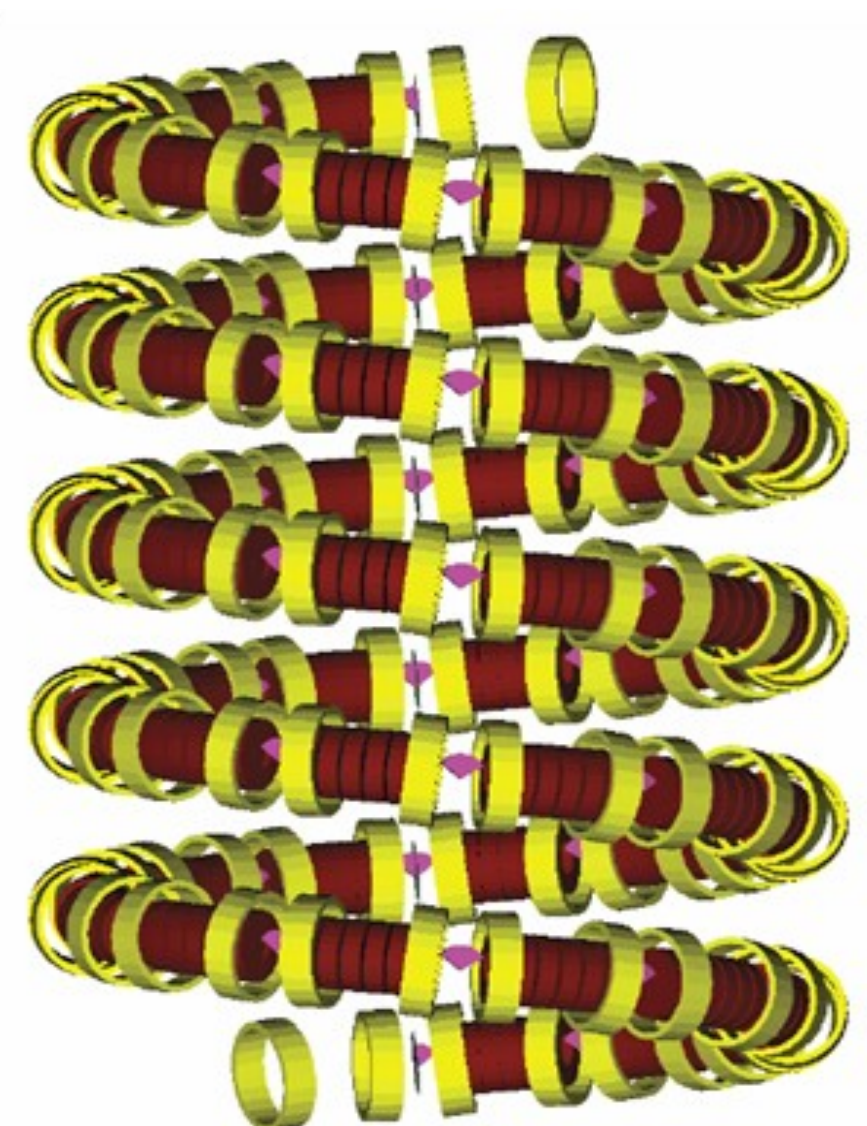
Alternating solenoid channel is recognized now as a suitable facility for 4D muon cooling. It has several regions of stability which traditionally are referred to FOFO, RFOFO, and Half-Flip versions of the channel. A possibility to transform any of them to 6D cooling channel by alternating tilt of the solenoids is a concern of this work.

## Transformation of 4D to 6D cooling channel



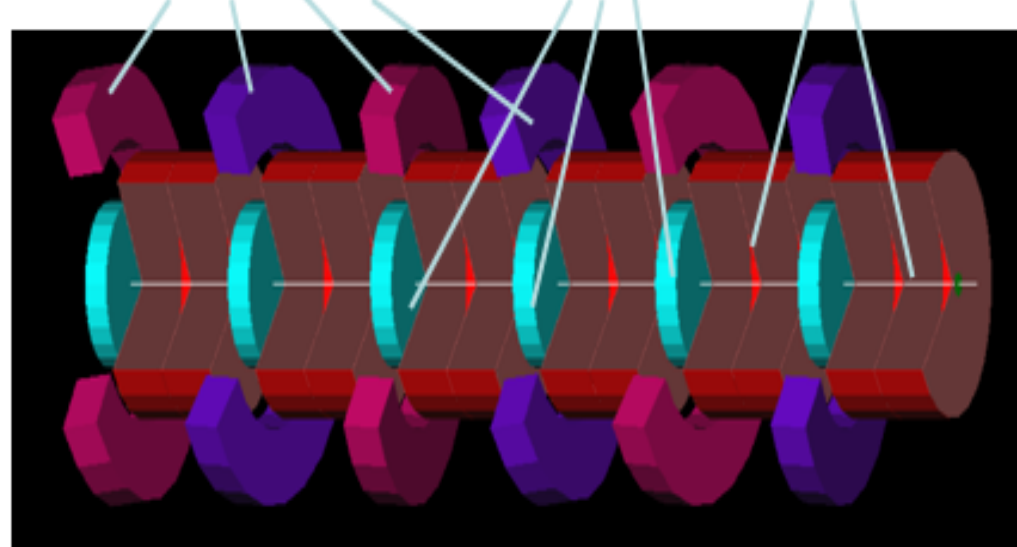
The transformation is achieved by alternating inclination of solenoids at small angle (typically 10-40 mrad) in horizontal plane. It gives rise to transverse periodic orbit and dispersion which can be used for emittance exchange with help of wedge absorbers. Such a channel has about the same performance as other known 6D cooling channels with a comparable field being simpler in construction.

“Guggenheim”



Helical Cooling Channel

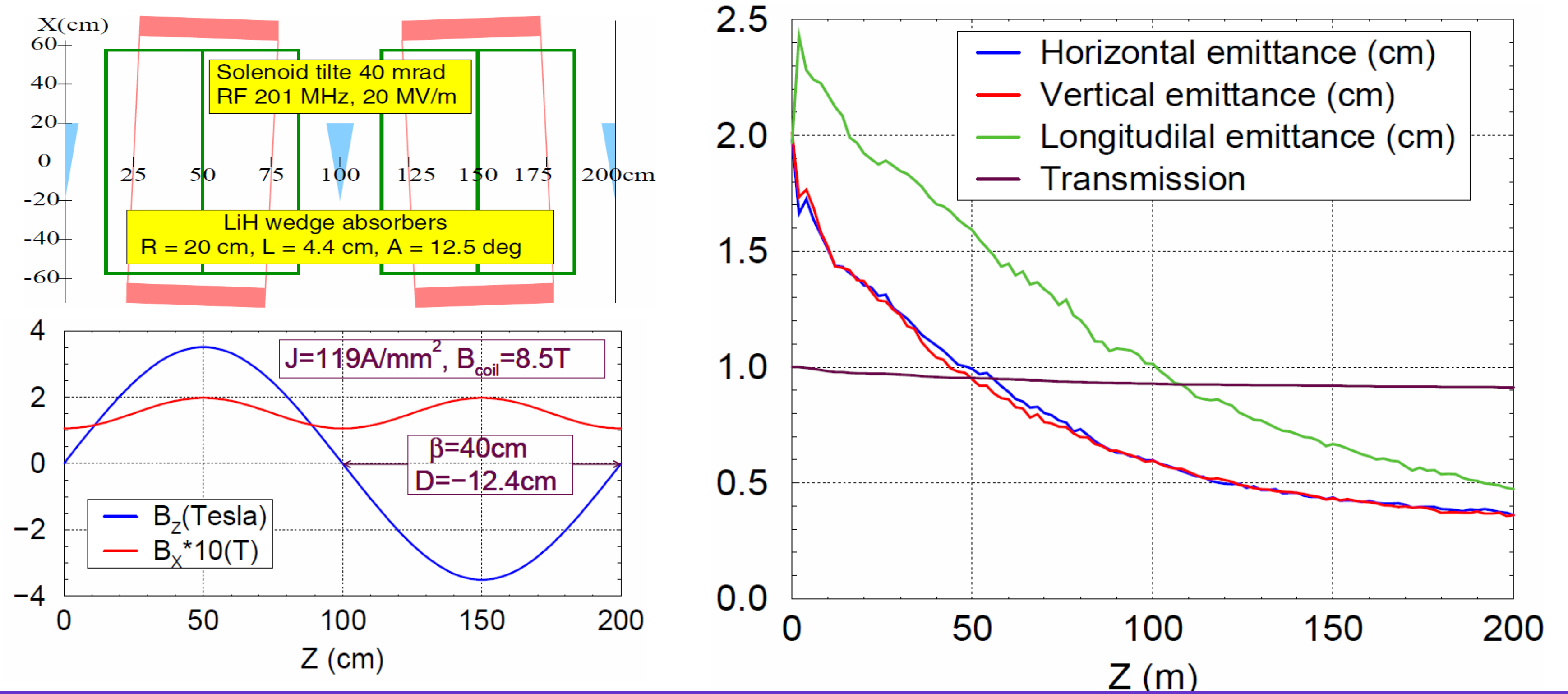
Helical FOFO Snake



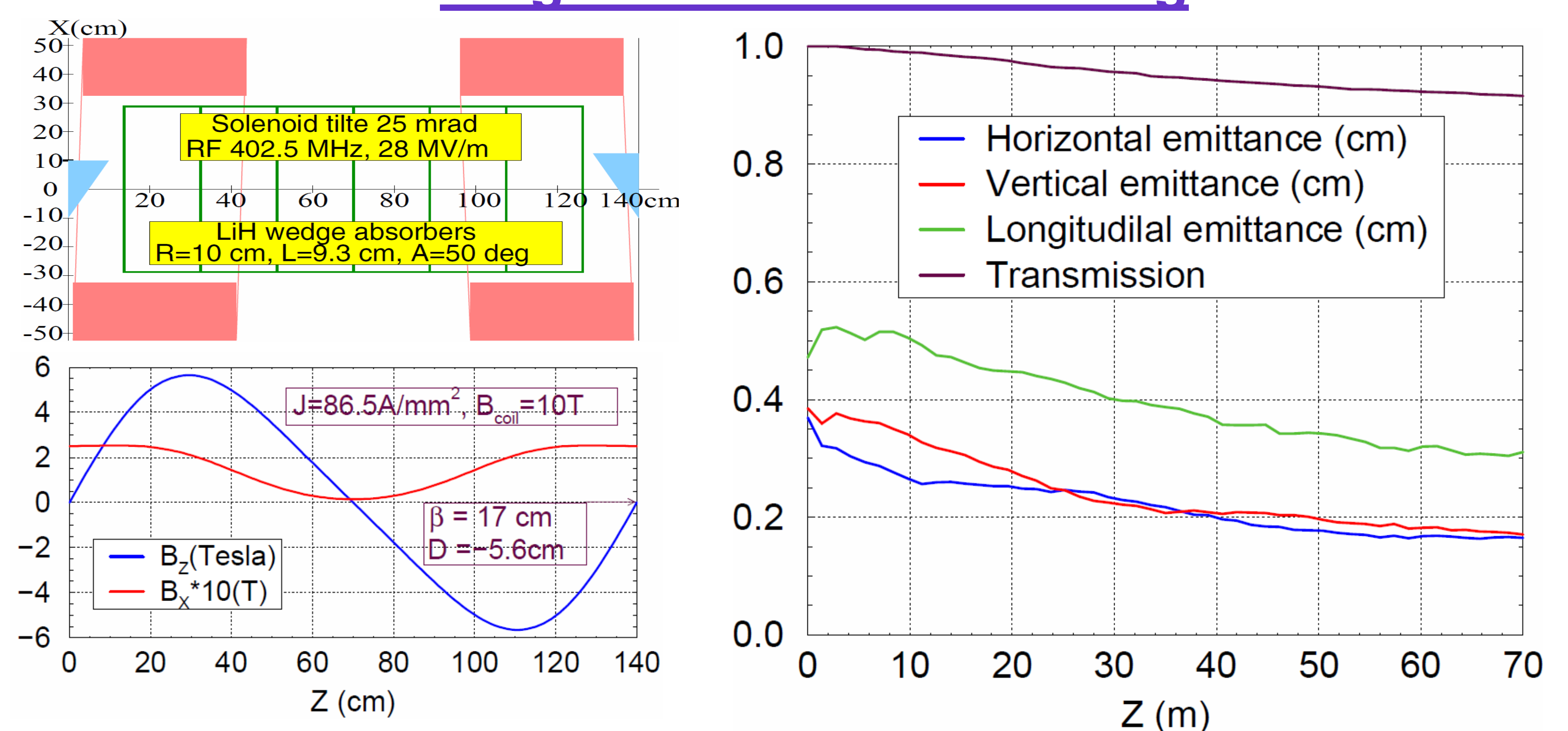
## Cooling simulation

Results of simulation are presented in the right-hand column. Three versions of the cooling channel are considered being adapted for different beam acceptances. They can be combined into a series by adding of appropriate matching section (not considered)

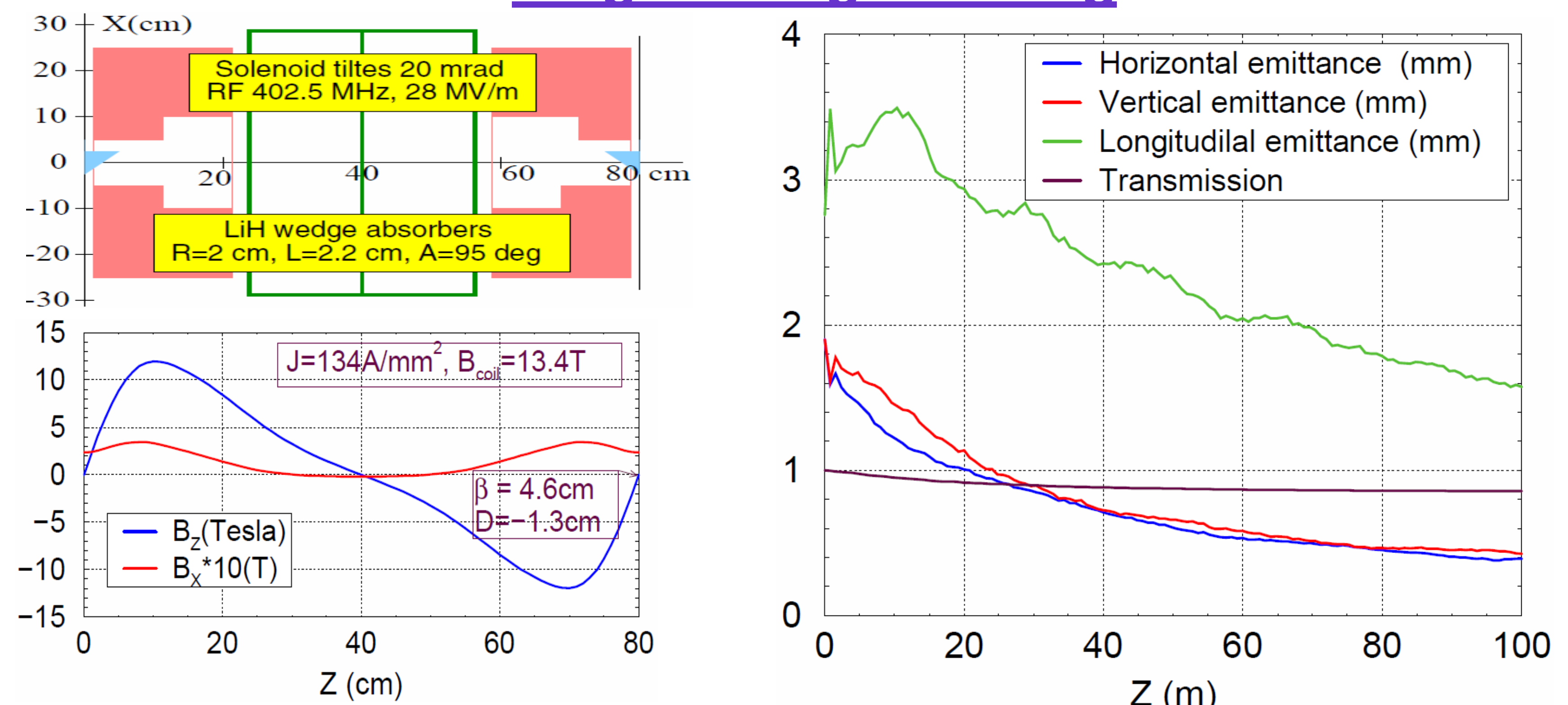
## Stage 1: Low cooling



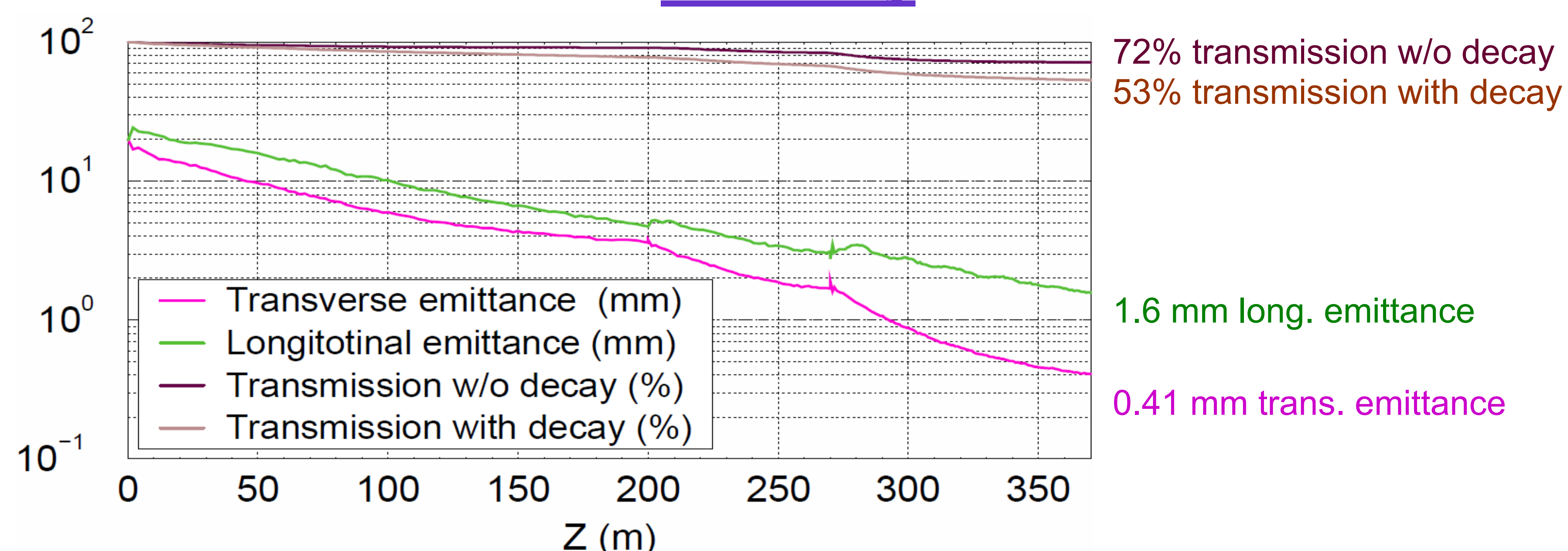
## Stage 2: Moderate cooling



## Stage 3: High cooling



## Summary



**Conclusion** Transverse emittance 0.4 mm and longitudinal emittance about 1.6 mm can be obtained with alternating tilted solenoids cooling channel at current density up to 134 A/mm<sup>2</sup> and coil field strength up to 13.4 T.



*Solenoid field and Li lens gradient in the joint. Adiabatic matching with  $d\beta/dz=0.25$  is achieved at maximal solenoid field 30-50 T, and Li lens gradient from 12 to 100 T/cm.*

## Abstract

**Any rectilinear alternate solenoid 4D cooling channel can be transformed to a rectilinear 6D cooling channel by small alternating tilt of the solenoids**